

### What Is Claimed Is:

1. An electromagnetic ultrasonic probe for coupling-media-free generation and reception of ultrasonic waves in the form of linearly polarized transverse waves in a workpiece (5), respectively from a workpiece (5), having
  - a unit which generates the ultrasonic waves inside the workpiece (5) and which is provided with a transmission coil arrangement (7), to which a high-frequency voltage can be applied to generate a high-frequency magnetic field, and a premagnetizing unit (V) to generate a quasi-static magnetic field superimposing the high-frequency magnetic field in the workpiece (5),
 and
  - an ultrasonic waves reception unit providing a reception coil arrangement (8) which can be connected to an evaluation unit, with
 the transmission coil arrangement (7) and the reception coil arrangement (8) being disposed torus-shaped at least on one partially toroidally designed magnetic core (6), which is provided with two front ends (11) which can be turned to face the workpiece (5) and via which the high-frequency magnetic fields can be coupled into, respectively coupled out of, the workpiece (5),
 

**wherein** the premagnetizing unit (V) can be contacted directly or indirectly with the workpiece (5) via a contact area (9) and

the at least one partially torodially designed magnetic core(6) is disposed laterally next to the contact area (9) of the premagnetizing unit (V) in such a manner that the premagnetizing unit (V) can project over the partially toroidally designed magnetic core (6) perpendicular to the contact area (9).
2. The electromagnetic ultrasonic probe according to claim 1,
 

**wherein** the premagnetizing unit (V) generates a quasi-static magnetic field whose magnetic field lines pass through the contact area (9) largely perpendicular thereto.

3. The electromagnetic ultrasonic probe according to claim 1 or 2,  
**wherein** the premagnetizing unit (V) provides at least one preferably two same name permanent magnets (3) whose magnetic field lines can be concentrated by means of a concentrator (4) on the contact area (9).
4. The electromagnetic ultrasonic probe according to claim 3,  
**wherein** the at least one permanent magnet (3) is at least partly enclosed by a soft magnetic workpiece (2) which bundles the magnetic field lines on the concentrator (4).
5. The electromagnetic ultrasonic probe according to claim 3 or 4,  
**wherein** the concentrator (4) is made of a soft magnetic material and is provided with two surfaces opposite each other, of which one is larger than the other and the smaller surface determines the size of the contact area (9) and the larger surface is connected to the soft magnetic workpiece (2).
6. The electromagnetic ultrasonic probe according to claim 5,  
**wherein** the concentrator (4) is provided with an electrically nonconducting material in which ferromagnetic particles are embedded matrix-like,  
or the concentrator (4) comprises a stack-like arrangement of single metal plates.
7. The electromagnetic ultrasonic probe according to one of the claims 1 to 6,  
**wherein** the at least one partially toroidally designed magnetic core (6) has a partially toroidal plane (10) which forms with the contact area (9) an angle  $\alpha$  with  $0^\circ < \alpha < 90^\circ$ , preferably  $30^\circ < \alpha < 60^\circ$  and  
the front ends (11) of the partially toroidally designed magnetic core (6) forms an angle  $\alpha$  with the partially toroidal plane (10).
8. The electromagnetic ultrasonic probe according to one of the claims 1 to 7,  
**wherein** at least two partially torodially designed magnetic cores (6) are provided of which one provides the transmission coil arrangement (7) and the other the reception coil arrangement (8), and  
the partially toroidally designed magnetic cores (6) are disposed relative to the premagnetizing unit (V) on opposite sides.

9. The electromagnetic ultrasonic probe according to claim 8, **wherein** the partially toroidally designed magnetic cores (6) are disposed axially symmetrically to a symmetrical axis passing through the premagnetizing unit (V), and **wherein** the partially toroidal planes (10) of the partially toroidally designed magnetic cores (6) each form an angle  $\alpha$  with the contact area (9).
10. The electromagnetic ultrasonic probe according to one of the claims 1 to 9, **wherein** the at least one partially torodially designed magnetic core(6) is designed as a toroidal tape core.